Gateway Pacific Terminal
Environmental Noise
Technical Report

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AMEC
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ENVIRON

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Acronyms, Abbreviations, and Definitions

ac	acre
Acoustically neutral	a description of equipment or material such as a wind screen used over a sound level meter microphone that, due to its composition, has little or no effect on the sound pressure levels reaching the microphone
ANSI	American National Standards Institute; administrator and coordinator of the United States private sector voluntary standardization system establishing standard methods for defining equipment operations and techniques (e.g., defining a Type 1 sound level meter)
BNSF	Burlington Northern Santa Fe Railroad
CadnaA	Computer Aided Noise Abatement, a computer noise model used in this analysis
CFR	Code of Federal Regulations
Day-night sound level (L_{dn})	A 24-hour sound level metric similar to a 24-hour L_{eq}, except the L_{dn} includes an additional 10 dBA added to sound levels in each hour between 10 PM and 7 AM to account for increased sensitivity to noise during times when people are typically trying to sleep
dB	decibel, referring to a unit measured on the decibel scale used to quantify sound levels
dBA	A-weighted decibel, a system for weighting measured sound levels to reflect the frequencies that people hear best
Distance attenuation	the rate at which sound levels decrease with increasing distance from a noise source based on the dissipation of sound energy as the sound wave increases in size (think of a balloon getting thinner as it becomes more inflated)
EDNA	Environmental Designation for Noise Abatement, an area or land use zone within which maximum permissible noise levels are established based on uses and/or zoning
EPA	US Environmental Protection Agency
Equivalent sound level (L_{eq})	A sound level metric that is the level that if held constant over the same period of time would have the same sound energy as the actual, fluctuating sound (i.e., an energy-average sound level)
Federal preemption	A preemption of local requirements due to control by federal statute or policy; e.g., trains involved in interstate commerce are exempt from local noise rules by virtue of federal control of such sources
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
ft	feet
FTA	Federal Transit Administration
GPT	Gateway Pacific Terminal
HII	Heavy Impact Industrial Zone
ISO	International Organization for Standardization, which establishes standard methods and procedures for accomplishing specific activities and calculations. The ISO has defined a number of standards related to the quantification of environmental noise.
L_{dn}	Day-night sound level (see above)
L_{eq}	Equivalent sound level (see above)

LII	Light Impact Industrial Zone
L_{max}	Maximum sound level; highest sound level within a specified time interval; Fast L_{max} is a 125 millisecond (1/8 second) sound level
L_n	Statistical noise level, the level exceeded during n percent of the measurement period, where n is a number between 0 and 100 (for example, L_{50} is the level exceeded 50 percent of the time)
Maximum permissible level	Term used in state and local noise rules in Washington State to define base sound levels specified in these regulations. Such base levels are often allowed to be exceeded for defined time periods. *Not* to be confused with L_{max} or the actually allowed maximum sound level limit.
Model Receptor	A theoretical location used in computer modeling at which the model calculates sound levels from a source or sources. Modeling receptors are usually placed at locations representing one or more potentially noise-sensitive uses.
NEPA	National Environmental Policy Act
Noise contour	Graphic depiction of (usually) model-calculated sound levels showing changes with distance(s) from the noise source(s) and indicating changes due to any intervening obstacles such as buildings or terrain
Noise criteria	A set of definitions establishing the conditions under which a noise impact is determined to have occurred. The noise criteria applied in this assessment include those established by the FTA and adopted by the FRA.
Noise impact	A measured or model-calculated condition in which the absolute (i.e., total) sound level and/or a project-related sound level increase exceed a defined noise impact criterion.
Noise metric	One of a number of measures used to quantify noise (e.g., L_{eq}, or L_{max})
R10A	Rural Zone, 1 Residence/10 Acres
R5A	Rural Zone, 1 Residence/5 Acres
RCNM	Roadway Construction Noise Model
ROW	right-of-way
SEPA	Washington State Environmental Policy Act
SLM	Sound level measurement
Sound level	Sound pressure level (see below)
Sound power level	A measure of the sound energy emitted by noise source expressed as energy per unit of time. *Not* to be confused with sound pressure level.
Sound pressure level	Ten times the base-10 logarithm of the square of the ratio of the mean square sound pressure, in a stated frequency band (often weighted), and the reference mean-square sound pressure of 20 μPa, which is approximately equal to the threshold of human hearing at 1 kHz. Sound pressure level is expressed in decibels.
Type I meter	A type of sound level meter defined by ANSI as being to measure sound pressure levels to an accuracy within 0.5 dBA
UGA	Urban Growth Area
WAC	Washington Administrative Code
WCC	Whatcom County Code

Preface

Pacific International Terminals, Inc., a subsidiary of SSA Marine, proposes to develop the Gateway Pacific Terminal (the "terminal"), a multimodal terminal for transfer of dry bulk commodities, at Cherry Point in Whatcom County, Washington. Construction and operation of the terminal and associated facilities require the approval of local, state, and federal agencies. Agency decision makers are to be informed of the potential environmental impacts of the proposed project by preparation of an Environmental Impact Statement (EIS). The EIS will be prepared under guidelines of the National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA) by a lead federal agency, a lead state agency, and a lead local agency working in cooperation.

This report is one of several technical reports prepared on behalf of Pacific International Terminals, Inc. that provides technical information about the existing conditions of the proposed project site, and in some cases, the projected effects of project operations. It is provided to the lead federal, state, and local agencies for their use in preparation of a Draft EIS. Several of the technical reports have also been prepared to support specific project permit applications submitted to local, state, and federal agencies or as part of the consultation process with resource agencies and affected Indian nations.

A more detailed description of the proposed terminal, including a complete list of proposed commodities and the phasing plan, is provided in the *Revised Project Information Document* (Pacific International Terminals, Inc., 2012).

1 Summary

This report documents the environmental noise impact and mitigation assessment performed by ENVIRON International Corporation (ENVIRON) as part of the environmental review for the proposed Gateway Pacific Terminal project at Cherry Point in Ferndale, WA. The analysis included baseline sound level measurements in several locations within the study area to document existing sound levels. ENVIRON then used noise modeling to estimate sound levels that would result from operation of the proposed facility at full buildout (in 2026).

The noise modeling considered noise from all expected terminal activities and equipment and noise from trains traveling along the Custer Spur between the Custer Wye/Valley Yard and the GPT terminal site.

The environmental noise impact assessment indicated that noise from on-site terminal operations would easily comply with applicable noise limits at all nearby residential locations. At the industrial property boundary south of the stockpile area, noise from a conveyor drive could result in a sound level exceeding the applicable industrial noise limit of 70 dBA. However, there are several means available for reducing the sound levels at this property boundary if necessary, including specification of quieter equipment and/or use of an enclosure or barrier around the conveyor drive. The ultimate facility design will ensure compliance with applicable noise limits at all site boundary locations.

Although compliance with the applicable noise limits is expected, the increase in off-site trains traveling on the Custer Spur from the Valley Yard to the terminal could result in numerous moderate noise impacts and several severe noise impacts (under FTA criteria) at residences near the rail line and near at-grade rail crossings. The projected severe noise impacts are due primarily to the use of locomotive horns whenever a train travels over an at-grade road crossing. Installation of quadrant gates at two currently gated crossings (i.e., at Bay and Kickerville Roads) and use of wayside horns instead of locomotive-mounted horns at these crossings would reduce the number of moderate noise impacts and eliminate the predicted severe noise impacts at all but one residence. The remaining severe impact would persist because the affected receiver is near an unprotected at-grade crossing of Ham Road, and wayside horns were not considered for this crossing.

2 Introduction

This report documents the environmental noise impact and mitigation assessment performed by ENVIRON International Corporation (ENVIRON) as part of the environmental review for the proposed Gateway Pacific Terminal project at Cherry Point in Ferndale, WA.

3 Project Description

Pacific International Terminals, Inc. (Pacific International Terminals) is proposing to develop the Gateway Pacific Terminal (GPT) at Cherry Point in Whatcom County, Washington (**Figure 1**). Designed for export and import of dry bulk commodities, the proposed Terminal would include a deep-draft wharf with access trestle, dry bulk materials handling and storage facilities, and rail transportation access.

The proposed Gateway Pacific Terminal would serve as a deep-water, multimodal Terminal for the export and import of dry bulk commodities between rail and oceangoing vessels. [1] The project area encompasses 1,200 acres out of which the Terminal infrastructure would be developed on approximately 334 acres. The project area is located in the Cherry Point Industrial Urban Growth Area (UGA), which is zoned for heavy-impact industrial land use. Under the Whatcom County Shoreline Management Program, the property is designated as part of the Cherry Point Management Area, where port and water-dependent industrial facilities are permitted.

The Terminal layout and design have evolved from the project design previously permitted by Whatcom County. The current design reflects changes in international dry bulk commodity demand and vessel size and incorporates changes based on requests from regulatory authorities and ongoing discussions with stakeholders. The proposed design and operational plan for the GPT reflect considerations of potential environmental impacts and Tribal concerns, and the resulting design includes proposed measures to mitigate those impacts and concerns. The design also includes measures required to meet existing regulatory standards regarding environmental protection.

(1) Dry bulk commodities include forest, agricultural, and mining products that are particulate in nature that are not processed on site nor packaged in any way. Dry bulk commodities are mainly transported as shiploads or trainloads, and handled using large-capacity containers or storage pads and dedicated transfer machinery generally incorporating conveyor systems. Dry bulk commodities include, for example, grain, iron ore, salts, coal, potash, and alumina. Bulk commodities are the "raw materials" upon which many industrial processes depend.

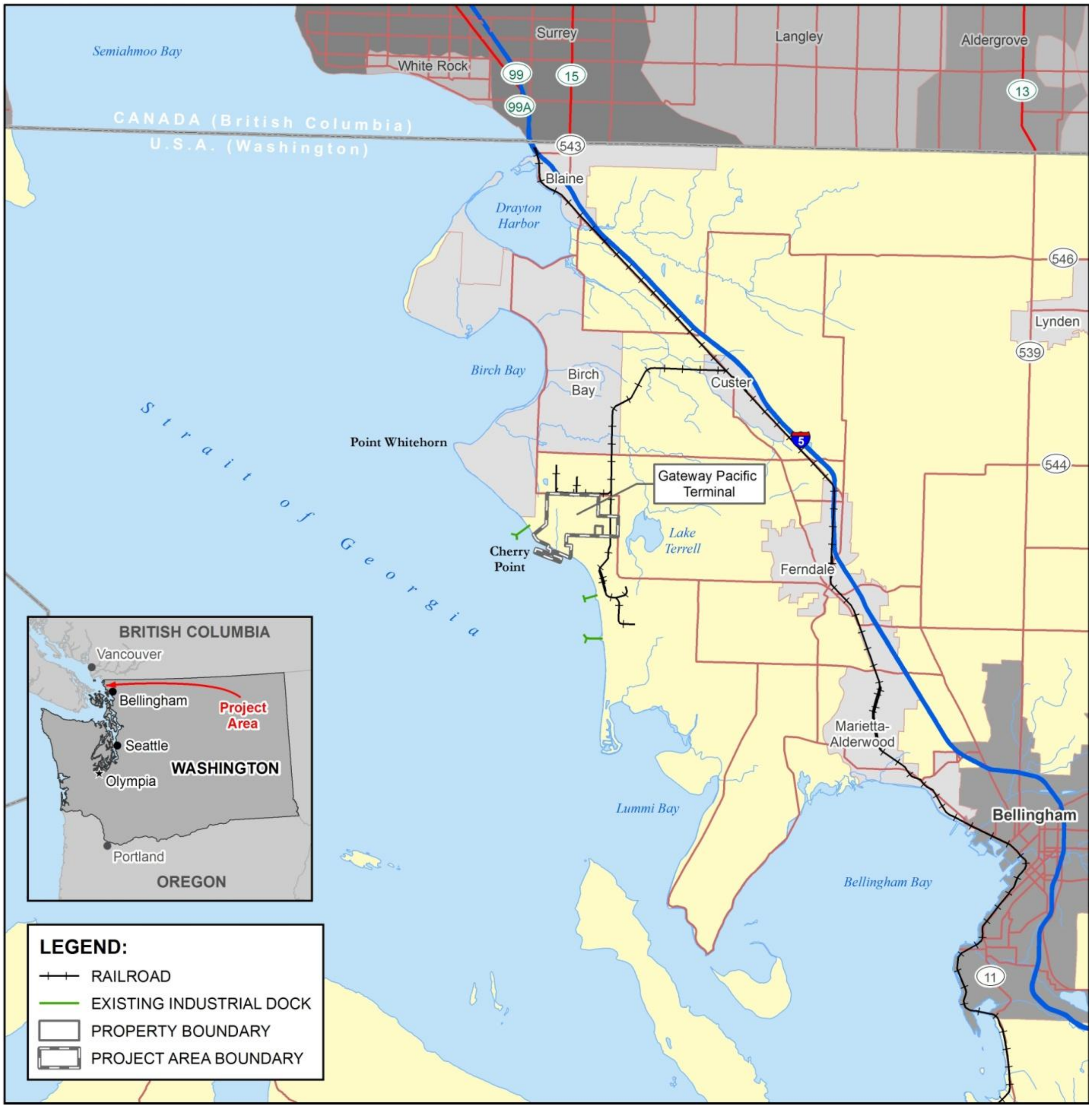

Figure 1. Project Vicinity Map

3.1 Terminal Design Elements

The proposed Terminal layout is depicted in **Figure 2**. It would include the following key facilities:

> **Wharf and Trestle –** The proposed Terminal's wharf and trestle would be located in an area where deep water is close to shore allowing the Terminal to accept the largest and

most economic dry bulk carriers currently in service. The wharf would include three deep-water berths suitable for calls by Panamax and Capesize bulk carriers. [(2)] The ability to accommodate large vessels would minimize vessel traffic and maximize the efficiency of Terminal operations.

Materials Handling and Storage – The Terminal material handling and storage areas would consist of two areas: one for open air commodity storage and the other for covered and silo storage. [(3)] The storage areas would be serviced by two rail loops and other miscellaneous support facilities, including stormwater systems. Materials unloading, handling, and loading equipment would be installed that best protects the safety of employees and protects the environment during Terminal operations.

Rail Connection – The project area is served by BNSF Railway Company's (BNSF) Custer Spur Industrial rail line (Custer Spur), which connects to BNSF main line at Custer, Washington, approximately 6 miles from the project area. The Custer Spur/mainline connection is called the Custer Wye. The Custer Spur would provide access to the nationwide rail network.

The Terminal would be developed to have the capacity to export and import up to 54 million metric tons per year (mmtpy) of dry bulk commodities. The type and quantity of dry bulk commodities that would be handled at the Terminal will likely change over time and would depend on international market conditions and customer demands. Products to be exported to the international market would include coal, grain products, potash, calcined petroleum coke, and other bulk commodities. The main features of the proposed Terminal are shown in **Figure 2**.

As a deep-water, multimodal marine terminal for the export and import of dry bulk commodities, the Terminal has been designed to meet the operational needs of Pacific International Terminals and to serve dynamic international bulk commodity markets successfully over the long term. The Terminal design provides maximum flexibility to handle a wide range of commodities as market needs and customer demands change over time. The deep-draft wharf and storage and handling areas allow the Terminal to load large, ocean-going vessels efficiently for shipment of commodities to Asian and other international markets.

Because the Terminal would handle a broad range of dry bulk commodities during its functional life, it would be designed so that only minor changes in infrastructure would be required to accommodate different commodities, or to change from export to import. For successful

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(2) **Panamax** vessels are the largest vessels that can currently transit the Panama Canal, with capacities of 65,000 to 85,000 dead weight tons (dwt); the dwt measure was historically based on long tons (2,240 pounds), but is now typically based on metric tons (tonnes). **Capesize** vessels are a class of bulk carrier with beams (widths) greater than 105.6 feet that are too wide to transit the Panama Canal, and therefore travel around the Cape of Good Hope or Cape Horn. The majority of existing Capesize fleet has capacities between 160,000 and 180,000 dwt.

(3) Certain dry commodities, such as grain and potash, are ruined by moisture and thus would be stored in covered structures or silos.

operation, a large land area is needed to provide sufficient space to store cargo temporarily at the Terminal and to support the required rail infrastructure. In addition, a deep-draft wharf is necessary to accommodate the large Panamax and Capesize vessels that currently service the import/export commodity trade.

The GPT facility would require extensive infrastructure and utilities as part of the development of the following project components:

- Two independently operational, industrial service rail loops (the "East Loop" and "West Loop") with sufficient trackage to handle projected bulk volumes by rail; both loops would be connected to the BNSF Railway Custer Spur, and each loop would house associated commodity storage capacity, material-handling and conveyance equipment, and other required bulk handling infrastructure
- A Shared Services Area providing access from the East and West Loops to the trestle and wharf
- A three-berth, deep-draft wharf with ship-loading equipment and an access trestle extending from the shoreline to the wharf
- Stormwater management systems and other utilities
- Specific design features to avoid, minimize, or compensate for the environmental effects of the Terminal
- Improvements to the existing BNSF Railway Custer Spur, including rail receiving/ departing infrastructure and, eventually, a double track from the Custer Wye to the proposed Terminal

Figure 2. GPT Facility General Layout

3.2 Expected Terminal Construction Staging and Throughput Phasing

3.2.1 Construction Stages

Pacific International Terminals expects to construct the Terminal in two stages, with four phases of gradually increasing throughput up to the facility design maximum. The first stage of construction is planned to commence in early 2014 after completion of necessary environmental reviews and issuance of required federal, state, and Whatcom County permits and authorizations. The second stage of construction would commence during construction of Stage 1, and completed in 2018. Additional materials-handling equipment would be added in subsequent years in response to operational needs.

Stage 1 construction would include installation of the following elements:

- Access trestle and wharf with one ship loader connected to one belt conveyor line
- The Shared Services Area, including the longshoreman's services building
- Compensatory mitigation for the fully developed facility (to address potential impacts of both Stage 1 and Stage 2 construction)
- Rail infrastructure required at full terminal capacity for the East Loop, including:
  - → All bulk earthwork required for full terminal capacity, including the earthworks required to support four inbound rail lines and four outbound rail lines
  - → Tracks for two inbound rail lines and two outbound rail lines (two tracks would be installed at a later date)
  - → One rail unloading station
- The entire East Loop stockpile patio area
- Two stacker/reclaimer lines
- Covered, elevated conveyor systems leading to and from the stacker/reclaimers and to the Shared Services Area
- Access roadways and parking areas for the East Loop and Shared Services Area
- Stormwater management facilities at the East Loop, Shared Services Area, wharf, and access trestle
- Administration and maintenance buildings for the East Loop
- All utilities that would be required at complete development, including water, electrical, wastewater management, and communications
- Up to three receiving and departure tracks on the Custer Spur near the Valley Yard
- Upgrade of the existing Custer Spur tracks to include structural hardening and continuous welded rail from the Valley Yard to the Terminal.

Stage 2 construction would complete the West Loop infrastructure and would provide improvements to the wharf to increase the material handling capacity by an additional 6 mmtpy of commodities. This stage of construction would add operating capacity and flexibility to handle different types and quantities of commodities at the Terminal.

Stage 2 construction would include installation of the following facilities:

- All of the West Loop's infrastructure, including:
  - → All bulk earthwork for the West Loop rail lines

- → Construction of the West Loop rail lines
- → One rail loading/unloading station
- → Access roadways
- → A-frame storage shed
- → Bulk storage silos
- → Conveyor lines
- → Stormwater management system

- A second ship loader on the wharf connected to a new conveyor line on the access trestle
- A second conveyor line in the Shared Services Area

3.2.2 Operational Stages

The Gateway Pacific Terminal **East Loop** would handle a wide variety of dry bulk commodities in its lifetime. Initially, it is anticipated that the East Loop would predominantly handle low-sulfur, low-ash coal. The general layout of the East Loop is shown in **Figure 2**. The terminal East Loop would include the following facilities:

- Service rail loop and unloading station
- 80-acre stockyard and associated machinery, including coal stacking and reclaiming machines
- Approximately 8,000 square feet of new buildings
- Conveyors for out-loading and in-loading commodities
- Access roadways

The East Loop would also include development of utilities, such as stormwater treatment facilities, electrical power, lighting, water, communications, and wastewater facilities.

The GPT **West Loop** would be designed to handle multiple types of dry bulk commodities. Similar to the East Loop, the West Loop would be designed so that changes in types of commodities or a change from export to import operation would require only minor changes in infrastructure. The West Loop is initially planned to handle export of calcined petroleum coke and potash, and would have rail infrastructure and covered bulk commodity storage areas. The area would include stacking and reclaiming conveyors, an unloading station, and out-loading/in-loading conveyor lines.

The terminal West Loop would include the following facilities:

- Rail loop and unloading station
- 17-acre storage area and associated machinery
- Conveyors and conveyor lines
- Access roadways

Development of the West Loop would also include electrical power, water, stormwater, lighting, communications, and wastewater facilities.

Four operational phases dictated by the growth in capacity of the Terminal (nominal maximal throughput) are anticipated (**Table 1**). The Terminal would begin operations at completion of Stage 1 construction with an operational capacity of approximately 25 million metric tons per year (mmtpy). At the completion of Stage 2 construction, Terminal capacity would reach 31 mmtpy. Two subsequent operational thresholds are envisioned (achieved approximately by 2021 and 2026), with the maximum capacity of the Terminal (54 mmtpy) reached during Operational Phase 4.

Table 1. Terminal Commodity-Handling Capacity by Development Phase

Operational Phase	Approximate Year	Capacity at West Loop (mmtpy)	Capacity at East Loop (mmtpy)	Total Nominal Maximum Capacity (mmtpy)
1	2016	0	25	25
2	2018	6	25	31
3	2021	6	39	45
4	2026	6	48	54

mmtpy = millions of metric tons per year

Source: Pacific International Terminals 2012

Capacity would grow from 31 to 45 mmtpy during Phase 3 by addition of a third stacker/ reclaimer at the East Loop to manage an additional stockpile of 1 million metric tons within the existing East Loop patio area. Additional equipment upgrades needed to accomplish this level of capacity would likely include:

- Two additional rail lines adjacent to the two existing lines in the East Loop (no new embankment would be needed because all earthwork was completed during Stage 1 construction)
- An additional shipping conveyor with its own surge bin, running from the East Loop to the Shared Services Area
- An additional (third) conveyor in the Shared Services Area, access trestle, and wharf
- A third ship loader added to the wharf

To reach the full operational capacity of 54 mmtpy, one additional stacker/reclaimer would be installed at the East Loop.

3.3 Facility Elements that would Minimize Noise Generation/Transmission

The GPT facility as proposed includes a number of components either specifically designed to minimize noise generation and emissions associated with on-site operations or whose use would have this effect. These aspects of the project include enclosing the railcar unloading facilities inside buildings, covering or completely enclosing most conveyors and all conveyor transfer points, and extending ship-loading equipment to within the holds of the vessels instead of dropping the materials from height. In addition, there are large intervening distances between on and near-site noise sources and off-site receiving locations that would serve to reduce facility noise. All of these factors were considered in the noise analysis.

4 Affected Environment

4.1 Noise Terminology and Descriptors

Noise is sometimes defined as unwanted sound; the terms noise and sound are used more or less synonymously in this report. The human ear responds to a very wide range of sound intensities. The decibel (dB) scale used to describe and quantify sound is a logarithmic scale that provides a convenient system for considering the large differences in audible sound intensities. On this scale, a 10-dB increase represents a perceived doubling of loudness to someone with normal hearing. Therefore, a 70-dB sound level will sound twice as loud as a 60-dB sound level.

People generally cannot detect sound level differences (increases or decreases) of 1 dB in a given noise environment. Although differences of 2 or 3 dB can be detected under ideal laboratory conditions, such changes are difficult to discern in an active outdoor noise environment. A 5-dB change in a given noise source would be likely to be perceived by most people under normal listening conditions.

When addressing the effects of noise on people, it is necessary to consider the "frequency response" of the human ear, or those sound frequencies that people hear most effectively. Sound-measuring instruments are therefore often programmed to "weight" sounds based on the frequency spectrum people hear. The frequency-weighting most often used to evaluate environmental noise is called A-weighting, and measurements using this system are reported in "A-weighted decibels" or dBA. All sound levels discussed in this evaluation are reported in A-weighted decibels.

As mentioned above, the decibel scale used to describe noise is logarithmic. On this scale, a doubling of sound-generating activity at a source (i.e., a doubling of the sound energy produced) causes a 3-dBA increase in average sound produced by that source, not a doubling of the loudness of the sound (which requires a 10-dBA increase). For example, if traffic along a road is causing a 60-dBA sound level at a nearby location, doubling the volume of traffic on this same road would cause the sound level at the same location to increase to 63 dBA. Such an increase might not be discernible in a complex acoustical environment.

Relatively long, multi-source "line" sources such as roads with steady traffic emit cylindrical sound waves. Due to the cylindrical spreading of these sound waves, sound levels from such sources decrease with each doubling of distance from the source at a rate of 3 dBA. Sound waves from discrete events or stationary "point" sources (such as a conveyor motor in a stationary location) spread as a sphere, and sound levels from such sources decrease 6 dBA per doubling of the distance from the source. Conversely, moving half the distance closer to a source increases sound levels by 3 dBA and 6 dBA for line and point sources, respectively.

For any noise source, a number of factors affect the efficiency of sound transmission traveling from the source, which in turn affects the potential noise impact at off-site locations. Important factors include distance from the source, frequency of the sound, absorbency and roughness of the intervening ground (or water) surface, the presence or absence of obstructions and their absorbency or reflectivity, and the duration of the sound. The degree of impact on humans also depends on existing sound levels, and who is listening. Typical sound levels of some familiar noise sources and activities are presented in **Table 2.**

Table 2. Sound Levels Produced by Common Noise Sources

Thresholds/ Noise Sources	Sound Level (dBA)	Subjective Evaluations [(a)]	Possible Effects on Humans [(a)]
Human Threshold of Pain Carrier jet takeoff at 50 ft	140	Deafening	Continuous exposure to levels above 70 can cause hearing loss in majority of population
Siren at 100 ft Loud rock band	130		
Jet takeoff at 200 ft Auto horn at 3 ft	120		
Chain saw Noisy snowmobile	110		
Lawn mower at 3 ft Noisy motorcycle at 50 ft	100	Very Loud	
Heavy truck at 50 ft	90		
Pneumatic drill at 50 ft Busy urban street, daytime	80	Loud	
Normal automobile at 50 mph Vacuum cleaner at 3 ft	70		Speech Interference
Air conditioning unit at 20 ft Conversation at 3 ft	60	Moderate	
Quiet residential area Light auto traffic at 100 ft	50		Sleep Interference
Library Quiet home	40	Faint	
Soft whisper at 15 ft	30		
Slight rustling of leaves	20	Very Faint	
Broadcasting Studio	10		
Threshold of Human Hearing	0		

[(a)] Note that both the subjective evaluations and the physiological responses are continuums without true threshold boundaries. Consequently, there are overlaps among categories of response that depend on the sensitivity of the noise receivers.

Source: EPA 1974 and Others

Environmental noise is usually described in terms of certain "metrics" that allow comparison of sound levels at different locations or in different time periods. Federal regulatory agencies often use the equivalent sound level (L_{eq}) or the day-night sound level (L_{dn}) to characterize sound levels and to evaluate noise impacts. The L_{eq} is the level that if held constant over the same period of time would have the same sound energy as the actual, fluctuating sound. As such, the L_{eq} can be considered an energy-average sound level. Because the L_{eq} considers sound levels over time, this metric accounts for the number and levels of noise events during an interval (e.g., 1 hour) as well as the cumulative duration of these events. The L_{dn} is like a 24-hour L_{eq}, except that the calculation adds 10 dBA to the sound levels between 10 PM and 7 AM to account for possible sleep disturbance. The L_{dn} is used to describe the noise environment in areas where there is both nighttime and daytime use, such as residences.

4.2 Regulatory Limits and Guidelines

4.2.1 Local Noise Regulations

The proposed project site is located in unincorporated Whatcom County. Chapter 20.80.620 of the Whatcom County Code adopts regulations established in Chapter 173-60 of the Washington Administrative Code (WAC).

Chapter 173-60 of the WAC limits the levels and durations of noise crossing property boundaries (**Table 3**). Allowable "maximum permissible" sound levels depend on the Environmental Designation of Noise Abatement (EDNA) of the source of the noise and the EDNA of the receiving property. WAC 173-60-030 stipulates that EDNA land classification shall conform to land *uses* unless a local jurisdiction has adopted a program in which EDNA classifications are based on zoning. Generally, lands of residential use are considered Class A EDNAs, commercial properties are considered Class B EDNAs, and industrial areas are considered Class C EDNAs.

Table 3. WAC Maximum Permissible Environmental Noise Levels

EDNA of Noise Source	EDNA of Receiving Property		
	Class A [a] (Day/Night)	Class B	Class C
Class A	55/45	57	60
Class B	57/47	60	65
Class C	60/50	65	70
Noise Limits for Industrial Noise Received on Adjacent Industrial (Class C) Properties (All Hours)			
L_{25}	$L_{8.3}$	$L_{2.5}$	L_{max}
70	75	80	85
Noise Limits for Industrial Noise Received on Adjacent Residential (Class A) Properties (Daytime)			
L_{25}	$L_{8.3}$	$L_{2.5}$	L_{max}
60	65	70	75

[a] Limits for noise received in Class A EDNAs are reduced by 10 dBA during nighttime hours (10 PM to 7 AM).

Source: WAC 173-60-040

The WAC "maximum permissible" noise levels can be exceeded for certain periods of time: up to 5 dBA for no more than 15 minutes in any hour, up to 10 dBA for no more than 5 minutes of any hour, or up to15 dBA for no more than 1.5 minutes of any hour. These allowed short-term increases can be described and measured in terms of the percentage of time a certain level is exceeded using a statistic called an interval "L_n." For example, the hourly L_{25} represents a sound level that is exceeded 25 percent of the time, or 15 minutes in an hour. Similarly, $L_{8.33}$ and $L_{2.5}$ are the sound levels that are exceeded 5 and 1.5 minutes in an hour, respectively. The "maximum permissible" levels are not to be exceeded by more than 15 dBA at any time, and compliance with this limit is usually assessed using a metric called the L_{max}, which is the maximum short-term sound level over a given time interval. The specific noise limits that derive from these combinations of factors are shown in the lower portion of **Table 3** for both adjacent industrial and residential properties.

The WAC noise rule identifies a number of noise sources or activities that are exempt from the noise limits shown in **Table 3**. The following sources are among those specifically exempted:

- sounds created by motor vehicles on public roads when individual vehicles are subject to performance standards regulated by WAC 173-62 (motor vehicle fleet performance standards)
- sounds caused by motor vehicles, licensed or unlicensed, when operated off public highways, except when such sounds are received in Class A EDNAs
- sounds created by surface carriers engaged in interstate commerce by railroad
- sounds created by warning devices not operating continuously for more than five minutes (such as back-up alarms on vehicles), and
- sounds originating from temporary construction sites during all hours when the noise is received in Class B or C EDNAs and during daytime hours when received in Class A EDNAs

4.2.2 Federal Transit/Federal Railway Administrations' Noise Impact Criteria

The Federal Transit Administration (FTA) has defined noise impact criteria for transit and rail projects in the FTA manual entitled *Transit Noise and Vibration Impact Assessment* (FTA 2006). These criteria apply to transit projects including commuter and light rail; fixed facilities such as transit stations, maintenance facilities, and park and ride lots; buses in bus-only highway lanes; ferry terminals; and motor vehicles in route to and from transit facilities.

The Federal Railroad Administration (FRA) applies the same noise impact assessment procedures and impact criteria employed by the FTA. [(4)] And although the FTA/FRA noise impact criteria are not directly applicable to on-site and near-site rail activities related to the GPT project, these criteria provide a useful and objective method for assessing potential noise impacts from increases in noise directly attributable to all sources associated with this project.

The FRA noise impact criteria apply a sliding scale of impact levels (or thresholds) for project-related noise based on the existing sound levels and the amount of noise a project would contribute (**Figure 3**). The criteria are based on the land use category of the receiving properties. For this project, the receiving properties of concern are residences (shown as Category 2 in **Figure 3**), and the FRA criteria use the day-night sound level (L_{dn}) noise descriptor to include consideration of the potential for sleep disturbance.

Based on the FRA impact criteria, receiving locations with low existing sound levels can be exposed to greater increases in overall noise, after the addition of project noise, before an impact occurs. Conversely, locations with higher existing sound levels can be exposed to smaller increases in overall noise before an impact occurs.

[(4)] The FRA uses identical calculational procedures as the FTA for conventional passenger rail lines, fixed rail facilities, and horn noise assessment. FRA uses slightly different methods, primarily in the form of modified source noise levels, for estimating noise from freight rail facilities.

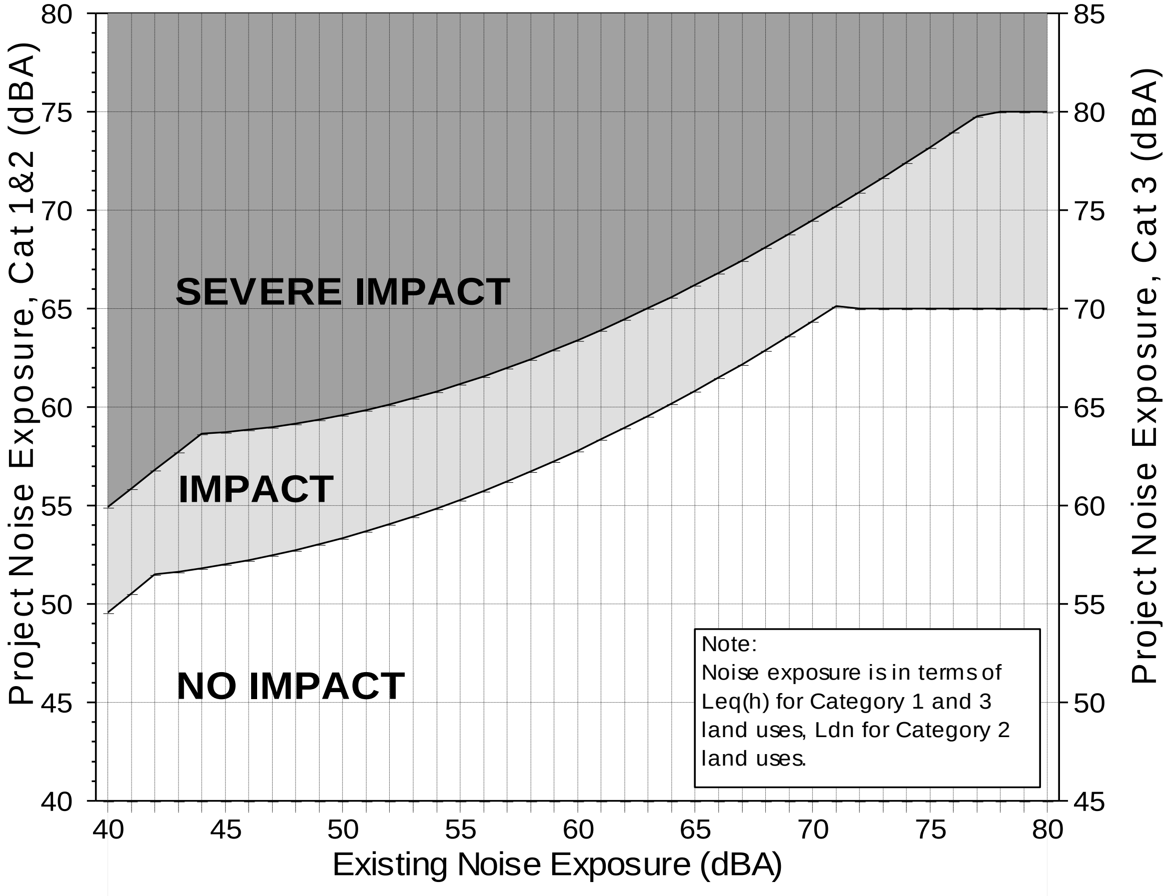

Figure 3. FTA/FRA Noise Impact Criteria

In addition to considering the day-night sound levels, FTA also recommends identifying the maximum sound level (L_{max}) from rail projects, particularly for those locations where the equipment and proximity to noise-sensitive uses indicate a potential for impacts. The L_{max} is the maximum sound level that occurs during a given time interval, and this metric provides additional information with which to evaluate the potential effect of individual train events. FTA does *not* employ direct noise impact criteria based on applying L_{max} levels.

4.3 Zoning and Land Use

The project site is currently undeveloped but is on land zoned Heavy Impact Industrial (HII) within a Major Port/Industrial portion of the Whatcom County Urban Growth Area (UGA). The nearest sensitive receivers to the project are residences on large lots. These residences are primarily on land zoned for rural uses (R5A and R10A), but some are on land zoned for Heavy and Light Impact Industrial uses (HII and LII).

4.4 Existing Sound Levels

The existing acoustic environment on and near the project site is due to a variety of existing noise sources such as traffic on local roads, trains, birds, aircraft, marine sources, and other miscellaneous sources. ENVIRON measured long-term (i.e., 95 hours) sound levels in April

2011 at four locations representing potentially affected receivers near the project site and along the rail transport route to the site. ENVIRON took the measurements using Type I Larson Davis 820 sound level meters, with an accuracy of approximately ±1 dBA. The meters had been factory certified within the previous 12 months and were field calibrated immediately prior to the measurements. ENVIRON fitted the microphones of the meters with acoustically neutral windscreens and set them approximately five feet above the ground (at a typical listening height).

Although unattended for most of the measurements, contributing noise sources were noted during the scouting visit to select locations and during deployment and retrieval of the sound level meters. The ranges of measured sound levels are summarized in **Table 4**. Brief descriptions of the measurement locations and noted noise sources are included in the lower portion of this table. Approximate locations of the measurements are depicted in **Figure 4** and the long term measurement data are charted in **Appendix A** .

Table 4. Measured Existing Sound Levels (Hourly Levels, dBA)

Location	Time	L_{eq}	L_{max}	L_2	L_8	L_{25}	L_{90}	L_{dn}
SLM1	Day	45-72	63-98	52-69	47-60	40-49	31-44	62-66 (64)
	Night	38-69	57-97	40-73	39-62	37-52	33-44	
SLM2	Day	59-67	77-94	71-75	63-71	48-64	33-44	67
	Night	48-67	75-94	47-75	36-70	33-58	30-42	
SLM3	Day	49-59	67-80	61-67	51-64	42-60	32-46	60-62 (61)
	Night	45-64	66-84	51-73	42-68	40-63	36-48	
SLM4	Day	39-70	55-99	45-82	42-73	39-62	32-51	53-59 (56)
	Night	38-51	49-75	42-59	40-55	39-52	34-48	

SLM1 – The meter was positioned in the side yard of 7729 Ham Road, approximately 320 feet south of the existing rail line. This residence is on the inside of the railway curve as it begins to head south west of Custer and has an unobstructed exposure to the railway. Noise sources during meter deployment included aircraft, local traffic, and train horns in the distance to the northeast. House construction to the south was barely audible.

SLM 2 – The meter was located approximately 50 feet south of Bay Road and west of the Custer Spur, approximately 300 feet from the rail line just as it straightens and heads south. At the time of deployment a train had been blocking the intersection with Bay Road for an hour and a half, and noise from the crossing signals dominated the sound environment.

SLM 3 – This meter was west of Kickerville Road between Lonseth Road and Henry Road. This location represents the sound environment at residences along Kickerville Road. During meter deployment, infrequent traffic along Kickerville Road was the dominant noise source when such traffic was present.

SLM 4 – This meter was on the water side of the residence at 5503 Maple Way at the south end of Koehn Road. Waves against the shore and sea birds dominated the sound environment during deployment. This area represents the nearest residential receivers northwest of the project site.

Figure 4. Sound Level Measurement (SLM) Locations

In general, residences adjacent to Kickerville, Bay, or Grandview Roads are currently exposed to moderate to loud levels of traffic noise. Residences near a railroad crossing are currently exposed to train passby, locomotive horn, and crossing bell noise. Residences overlooking the water are exposed to wind and water noise. These existing sources all contribute to measured sound levels somewhat higher than might be expected in an otherwise mostly undeveloped area.

5 Analytical Methods

5.1 Model

ENVIRON estimated noise generated by the facility as received at nearby residences using the CadnaA noise model. CadnaA is a sophisticated software program that enables noise modeling of complex industrial sources using sound propagation factors as adopted by ISO 9613. [(5)] Atmospheric absorption was estimated for conditions of 10°C and 70 percent relative humidity (i.e., conditions that favor propagation) and computed in accordance with ISO 9613-1. The modeling process included the following steps: (1) characterizing the noise sources, (2) creating 3-dimensional maps of the site and vicinity to enable the model to evaluate effects of distance and topography on noise attenuation, and (3) assigning the equipment sound levels to appropriate locations on the site. CadnaA then constructed topographic cross sections to calculate sound levels in the vicinity of the project site.

In addition to using the ISO 9613 procedures in CadnaA for on-site sources, ENVIRON used the FRA/FTA module available in CadnaA for modeling noise due to moving trains and locomotive horns. This module computes train noise using the source levels and methods outlined by the Federal Railroad Administration (FRA) and the Federal Transit Administration (FTA). The numbers of locomotives and lengths of rail cars were identified for each track, as well as information regarding train speeds and throttle settings.

For the modeling effort, ENVIRON used numerous modeling "receptor" locations representing the residences nearest the project site and along the Custer Spur rail line. The modeling receptors considered in the noise modeling are depicted in **Figure 5**.

[(5)] The ISO has established internationally recognized standard methods for calculating noise attenuation through the atmosphere.

Figure 5. Noise Modeling Receptor Locations

5.2 Estimated Existing Sound Levels

To assess potential noise impacts due to increases over the existing sound levels, ENVIRON identified the existing sound levels at each model receptor based on the sound level measurements described previously (Section **4.4**). The process was as follows.

Using the four SLMs identified in **Table 4** (page 15) as the basis, ENVIRON characterized the sound levels from the three major noise sources identified in the vicinity which are: the existing rail line and crossings, Bay Road, and Kickerville Road. Then, using the distances from each receptor location to each of these sources and applying a standard sound level distance attenuation equation, ENVIRON calculated the sound level at each receptor location due to each these three dominant area noise sources. The resulting estimated sound levels at each receptor location were used in the impact assessment; these levels are displayed in the summary of the impact analysis shown in **Table 9** (page 28).

5.3 GPT Noise Sources and Assumptions

The proposed shipping terminal would consist of four phases of development over a number of years. The final Phase 4 development would result in full operation of both the east and west loops by the year 2026. The noise impact assessment was based on assuming full operation of the entire facility after completion of Phase 4 development, with all on-site equipment operating simultaneously and continuously. Because it is highly unlikely that *every* piece of equipment would operate concurrently very often, this represents a conservative approach to the noise impact analysis that probably overstates actual noise associated with the facility operation.

In addition to on-site sources, there would be trains arriving, idling, unloading, and departing. While the trains are under BNSF control, under federal preemption, noise from the trains is exempt from compliance with state and local noise limits. The trains would not be under BNSF control when they are on site and being moved by indexers during unloading, so noise from this activity was included in the compliance assessment. Noise from on-site equipment and activities and from trains is discussed further below.

5.3.1 On-Site Terminal Equipment

The on-site equipment and activities expected to be the dominant noise sources associated with operation of the facility are identified in **Table 5**. The table indicates the number of units expected on the site in 2026 with full operation, and the approximate sound level 100 feet from each source (as estimated from the sound power level). All other equipment on the site (e.g., employee vehicles) is expected to provide have a negligible contribution to the overall sounds generated on the site, and such sources were not considered in the noise assessment. Note that all on-site equipment was assumed to operate continuously, 24 hours a day.

Table 5. Terminal and Railroad Noise Sources

Operational Noise Source	# Units Considered	Approximate Sound Level at 100 ft (dBA)	Data Source
On-Site Material Handling and Transfer			
Coal Car Dumper (rotational dumper inside building)	2	80	1
Coal Dumper Dust Collection Fans	2	76	2
Coal Train Indexer (moving trains through dumper)	2	61	3
Stacker/Reclaimer (stacking coal)	4	76	1
Dust Boss (dust control water sprayer)	38	71	4
Conveyor	19	56	2
Conveyor Drive Motor	7	74	2
Loader (dozer working around coal piles)	1	75	2
Train Car Bottom Dump Unload (west loop inside building)	1	68	2
West Dumper Dust Collector Fan	1	76	2
West Loop Train Indexer (moving trains through dumper)	1	61	3
Transfer Point Dust Collect Fan	5	76	2
Ship Loader	3	64	2
Idling Locomotives	Varies	68	2
Off-Site Train Sources			
Idling Locomotives	Varies	68	2
Moving Locomotives and Train Cars	Varies	Varies with speed	5
Locomotive Horns	Varies	104	5
Crossing Bells	8	65	2

Sources:

1) JASCO Research. *Airborne Noise Measurement Study for DRven Corporation's Proposed Ladd Marine Coal Terminal***.** May 29, 2007.
2) From archived data of noise sources measured by ENVIRON personnel
3) Pittsburgh Testing Laboratories, 1982. Measurements taken at Merom Generating Station, Merom, Indiana. Data provided by Dianna Tickner.
4) Manufacturer-provided information
5) CadnaA v4.1. DataKustik GmbH. FRA/FTA module.

5.3.2 Trains – On and Off-Site

With GPT Phase 4 development and full operation in 2026, up to nine trains would visit the facility during any 24-hour period. Of these, one would traverse the west loop and unload dry bulk material, and eight would traverse the east loop and unload coal. For purposes of the noise impact assessment (across the day) the west loop train was assumed to be a 170-car potash train with seven locomotives, and the east loop trains were assumed to be 150-car coal trains with five locomotives.

To estimate the worst-case hourly sound levels along the Custer Spur, ENVIRON assumed one potash train would arrive and one coal train would depart in a single hour. Over a 24-hour period, ENVIRON assumed five coal trains would arrive and depart during daytime hours (i.e., 7 AM to 10 PM) and three coal trains and one potash train would arrive and depart during nighttime hours (i.e., 10 PM to 7 AM).

The trains were assumed to travel 17 mph from the beginning of the Custer Spur to the GPT turnout.

5.3.3 Off-Site Crossing Bells and Locomotive Horns

Noise sources associated with off-site trains include crossing bells at gated crossings and locomotive horns sounded at all at-grade crossings. These sources were included in the noise modeling as follows:

- Crossing bells were included at the crossings of Grandview, Bay, Kickerville, and Valley View Roads. Bells were assumed to sound for six minutes during each train passby.
- Locomotive horns were assumed to sound for approximately 18 seconds during a train's approach to every at-grade road crossing, including those crossings with bells noted above and crossings at Aldergrove, Brown, and Ham Roads.

6 Potential Impacts of the Proposed Project

6.1 Construction

Pacific International Terminals expects to construct the Terminal in two stages. The first stage of construction would include the following elements:

- Construction of much of the infrastructure, structures, and stockpile areas in the East Loop
- Installation of the access trestle and wharf
- Upgrade of the existing Custer Spur tracks to include structural hardening and continuous welded rail from the Valley Yard to the Terminal

The second stage of construction would comprise construction of the West Loop and improvements to the wharf. Because Stage 2 construction activities would be farther from potentially affected residences than Stage 1 activities, any associated noise impacts would be less.

Stage 1 construction elements could be categorized as "typical" construction activities on the site, pile driving at/near the wharf, and railroad improvements off the site.

6.1.1 On-Site "Typical" Construction Activities

Noise from grading and construction activities for the terminal have the potential to affect nearby receivers, particularly residences east of the site. For daytime construction activities, the Washington Administrative Code exempts noise from temporary construction activity from the noise limits. The temporary nature of construction coupled with its restriction to daytime hours typically reduces the potential for significant impacts from construction activities and equipment.

Table 6 shows the overall hourly noise levels (L_{eqs}) from various construction activities (upper portion of table) and the range of sound levels (i.e., minimum to maximum levels) emitted by individual pieces of equipment (lower portion of table). Although temporary daytime construction noise is exempt from the State noise limits, these levels give an idea of the relative sound levels that can be expected from different kinds of equipment. Existing residences east of the terminal are more than 1,000 feet from the nearest construction activities (the installation of railroad tracks) and more than 4,000 feet from the main construction area (on-site structures, stockpile yard, etc.). In the absence of intervening terrain, structures, and/or dense vegetation, sounds from construction equipment and activities (usually point sources) decrease about 6 dBA for each doubling in distance from the source.

Table 6. Noise Levels from Typical On-Site Construction Activities and Equipment (dBA)

Activity	Range of Hourly Leqs		
	At 1000'	At 2000'	At 4000'
Clearing	57	51	51
Grading	50-62	43-56	37-50
Paving	47-62	40-56	34-50
Erection	47-58	40-52	34-46
Types of Equipment	**Range of Noise Levels**		
	At 1000'	**At 2000'**	**At 4000'**
Bulldozer	51-70	45-64	39-58
Dump Truck	56-68	50-62	44-56
Scraper	54-67	48-61	42-55
Paver	60-62	54-56	48-50
Generators	45-56	39-50	33-44
Compressors	48-55	42-49	36-43
Source: EPA, 1971			

As shown in **Table 6**, the estimated hourly Leqs from even the nearest construction activities (more than 1,000 feet from the nearest residences) are mostly at or below the noise level limit of 60 dBA that would apply to long-term operational noise. Added to the fact that construction would be temporary and limited to daytime hours, there would be little if any potential for significant noise impacts from "typical" on-site construction activities.

6.1.2 Pile Driving

The proposed project would require pile driving during construction of the wharf and portions of the trestle. Pile driving would occur over 6,000 feet from the nearest residences east and west of the site. Archived sound level measurement data of pile driving activities indicate that the hourly sound level (L_{eq}) of pile driving at a distance of 100 feet is approximately 86 dBA.[6] The maximum sound level (L_{max}) of pile driving is estimated to be 104 dBA at a distance of 100 feet.

[6] From ENVIRON's archive of pile driving measurements. The hourly L_{eq} comprised the placement and driving of two piles in a one-hour period.

ENVIRON modeled pile driving sound levels at the nearest residences to the site using the CadnaA noise model. The resulting modeled levels were hourly L_{eqs} in the 20s to low 30s dBA and L_{max}s in the mid-40s to low 50s dBA at the nearest residences. Because of the large distances and intervening terrain, estimated pile driving sound levels are greatly reduced at the nearest residences. However, even with fairly low levels of pile driving noise, the unique nature of pile driving impact noise may result in the loudest sounds being audible at the residences nearest this activity. This noise could be perceived by some people as intrusive and possibly annoying, but the low overall levels would minimize the potential for impacts.

6.1.3 Off-Site Rail Improvements

Improvement of the existing Custer Spur rail line from the Valley Yard to the site would entail the project-related construction activities nearest to residences. Two existing residences are within 200 feet of the existing track, and several residences are within 400 feet of the existing track.

Improvement of the railroad tracks would comprise "typical" construction activities associated with ground preparation and installation of new tracks. Construction noise levels when the activities are nearest the most-affected residences are displayed in **Table 7**.

Because of the linear nature of railroad tracks, construction of the railroad tracks would only occur near each affected residence for relatively short periods before the construction activities would move further away down the tracks. This fact and restriction of construction activities to daytime hours would minimize the potential for noise impacts.

Table 7. Noise Levels from Railroad Improvement Construction Activities and Equipment (dBA)

Activity	Range of Hourly Leqs		
	At 100'	At 200'	At 400'
Clearing	77	71	65
Grading	70-82	64-76	58-70
Installation	67-78	61-72	55-66
Types of Equipment	**Range of Noise Levels**		
	At 100'	**At 200'**	**At 400'**
Bulldozer	71-90	65-84	59-78
Dump Truck	76-88	70-82	64-76
Scraper	74-87	68-81	62-75
Paver	80-82	74-76	68-70
Generators	65-76	59-70	53-64
Compressors	68-75	62-69	56-63
Source: EPA, 1971			

6.2 Operation

The noise assessment considered two issues related to noise generated by operation of the GPT facility. ENVIRON evaluated *compliance* with applicable noise limits, and the potential for noise *impacts* based on the project-related changes in the acoustic environment. Both aspects of the analysis are discussed further below.

6.2.1 Compliance

ENVIRON assessed whether noise generated by on-site equipment and activities would comply with the Washington State noise limits (**Table 3**, page 12). For this evaluation, ENVIRON used noise modeling assuming full operation of all equipment in 2026 at receptors representing the residences nearest the project site. Results of the compliance assessment are presented in **Table 8**. As shown in **Table 8**, model-calculated sound levels at residences nearest the on-site sources easily comply with the noise limit of 50 dBA applied during nighttime hours, and the modeled levels are well below the higher daytime noise limit of 60 dBA.

Table 8. Model-Calculated Noise Levels from On-Site Sources Received at Nearby Residences (dBA, Hourly L_{eq})

Receptor	Level [a, b]	Noise Limit [c]	Comply? [d]
W1	33	50	Y
SE1	45	50	Y
SE2	45	50	Y
SE3	45	50	Y
SE4	46	50	Y
E1	44	50	Y
E2	43	50	Y
E3	42	50	Y
E4	42	50	Y
E5	37	50	Y
NE1	36	50	Y
NE2	34	50	Y
NE3	29	50	Y
NE4	29	50	Y
NE5	28	50	Y
NE6	24	50	Y

[a] The model-calculated sound levels are displayed as hourly L_{eq}s. Although the actual noise limits are based on the hourly L_{25}s, the on-site noise sources were assumed to operate continuously over an hour period, so the hourly L_{eq} and L_{25} would be expected to be very similar. Therefore, the L_{eq} can be used to estimate the potential L_{25} due to on-site sources.

[b] The model-calculated sound levels are only shown for those receivers within approximately 3 miles of any on-site noise sources.

[c] The limit shown is for nighttime hours (i.e., 10 PM to 7 AM). The daytime noise limit is 10 dBA *higher*. However, since peak hourly operations could occur anytime day or night, the more limiting 50 dBA was used for considering potential compliance.

[d] In this instance the test of compliance is with the 50-dBA nighttime limit that pertains at residential receivers as explained in note C.

ENVIRON also evaluated noise-limit compliance at adjacent industrially zoned property boundaries. For this assessment, ENVIRON used CadnaA noise modeling to generate noise contours (**Figure 6**) depicting cumulative hourly sound levels from all operational equipment. As can be seen in **Figure 6**, there is a small area on the undeveloped property immediately south of the coal piles where the facility noise might not comply with the 70-dBA limit that applies during all hours of the day. The model-calculated elevated sound levels at this location are due primarily to a nearby conveyor drive motor. But ENVIRON assumed the sound level for the motor was louder than the level estimated by the project proponent, so this assessment should be considered conservative. In the event it is determined that the facility noise does not comply with the noise limits at this property boundary, several measures could be used to reduce the sound levels and thereby ensure compliance. Potential noise control measures include the following: construction of a noise barrier along a portion of the property boundary, installation of the conveyor drive motor in an enclosure, specification of a quieter motor, or purchase of the property to the south by the project developer. Because this land is undeveloped and zoned for industrial uses, and because control measures are available in the vent such controls are needed, this small area with a projected sound level exceeding the noise limit is not taken to comprise a significant noise impact from facility operation.

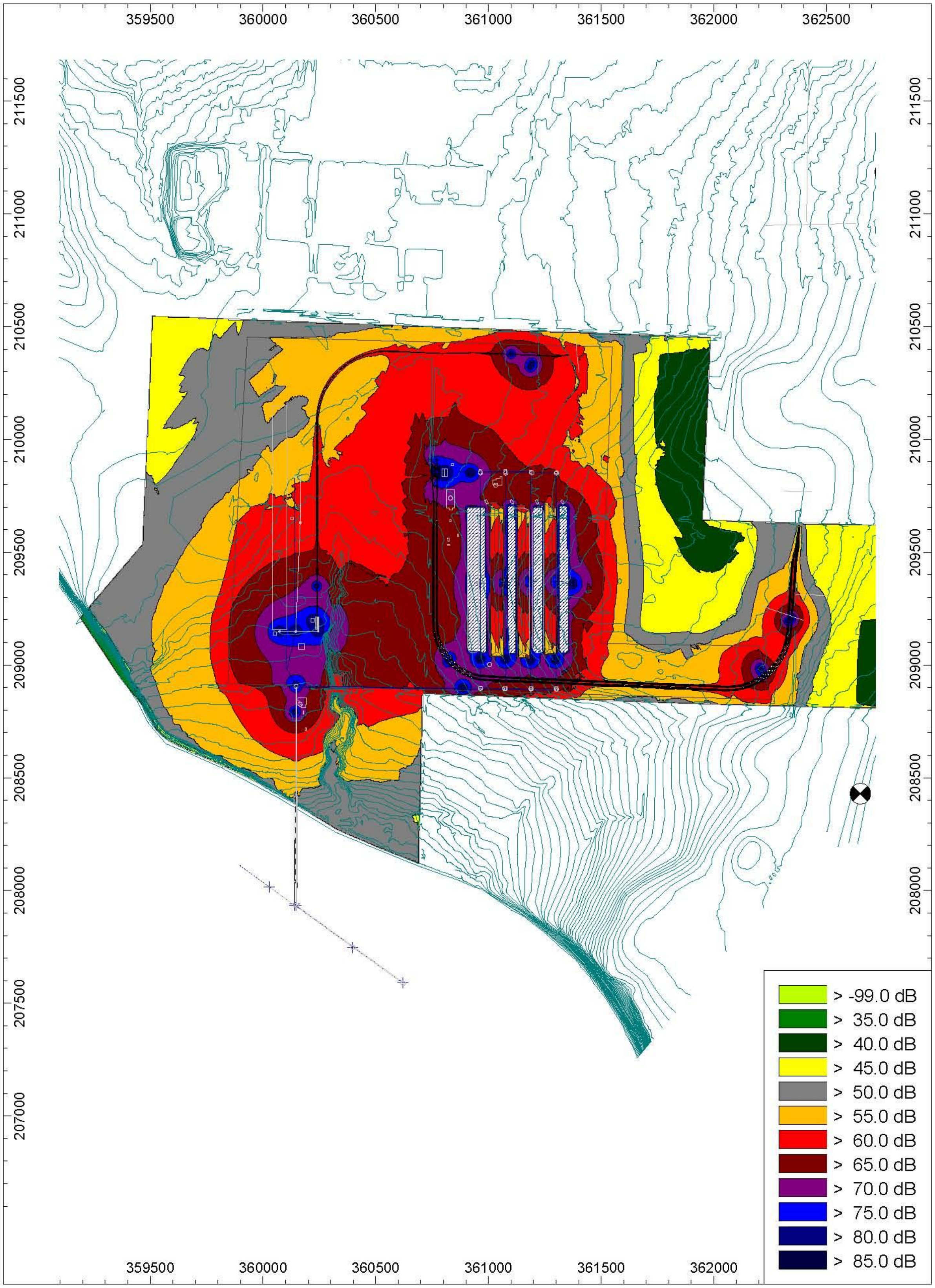

Figure 6. Adjacent Property Line Compliance Assessment Noise Contours

6.2.2 Noise Impact due to Sound Level Increases

In addition to considering the potential compliance of the facility with the WAC noise limits, ENVIRON also assessed the potential for noise impacts due to sources directly attributable to the project (including off-site trains) increasing the sound levels in the vicinity of the site and along the Custer Spur access route to the site. Using the assumptions described previously (Section **5.3**), ENVIRON considered cumulative noise from on-site sources and from trains traveling along the Custer Spur.

For this portion of the assessment, ENVIRON applied the FTA/FRA review methodology based on the 24-hour day-night sound level (L_{dn}) for considering potential impacts due to noise increases at residential receivers. In the absence of applicable standards or criteria for assessing impacts due to sound level increases, ENVIRON also applied the FTA/FRA noise impact criteria for this purpose.

As part of calculating the Ldn, ENVIRON assumed **all** on-site equipment would operate 24-hours a day, that five trains would arrive and depart the site during daytime hours (7 AM and 10 PM), and that four trains would arrive and depart the site during nighttime hours (10 PM and 7 AM).

The calculated cumulative sound levels, sound level increases, and determinations of the potential for noise impacts (under FTA criteria) are displayed in **Table 9**. As shown in **Table 9**, there are several receptors located very near the rail line that would experience moderate or severe impacts from the project. Note that predicted severe noise impacts (i.e., significant under SEPA and NEPA) are restricted to receptors located either very near the rail line or very near a rail crossing of a road. Terminal operations are a minor contributor to the overall noise levels at all affected locations.

Table 9. Impacts from Project-Related Noise Increases over Existing Levels (dBA, Ldn)

Receptor	Existing Level	Project Level	Cumulative Level	Increase	Moderate Impact? [a]		Severe Impact? [a]	
W1	56	40	56	0	56-62	N	>62	N
SE1	60	54	61	1	58-63	N	>63	N
SE2	58	53	59	1	57-62	N	>62	N
SE3	53	55	57	4	55-60	N	>60	N
SE4	61	55	62	1	59-64	N	>64	N
E1	57	56	60	2	57-62	N	>62	N
E2	57	56	59	3	57-62	N	>62	N
E3	56	56	59	3	56-62	N	>62	N
E4	62	58	63	1	59-64	N	>64	N
E5	56	54	58	2	56-62	N	>62	N
NE1	62	54	62	1	59-64	N	>64	N
NE2	58	58	61	3	57-62	Y	>62	N
NE3	65	67	69	4	61-66	Y	>66	Y
NE4	61	61	64	3	59-64	Y	>64	N
NE5	64	69	70	6	61-65	Y	>65	Y
NE6	67	71	72	6	63-67	Y	>67	Y
NE7	59	57	61	2	58-63	N	>63	N
NE8	55	55	58	3	56-61	N	>61	N
NE9	53	54	56	4	55-60	N	>60	N
CUSTER1	55	54	58	3	56-61	N	>61	N
CUSTER2	63	66	68	5	60-65	Y	>65	Y
CUSTER3	63	64	67	4	60-65	Y	>65	N
CUSTER4	61	63	65	4	59-64	Y	>64	N
CUSTER5	61	59	64	2	59-64	Y	>64	N
CUSTER6	52	58	59	7	55-60	Y	>60	N
CUSTER7	51	57	58	7	54-60	Y	>60	N
CUSTER8	51	56	57	6	54-60	Y	>60	N
CUSTER9	55	56	59	3	56-61	Y	>61	N
CUSTER10	56	56	59	3	56-62	Y	>62	N
CUSTER11	57	57	60	3	57-62	Y	>62	N

[a] Tests of moderate and severe noise impacts are based on comparison with FTA noise impact criteria.

6.2.3 Noise Impact due to Lmax Sound Levels

As indicated earlier, the FTA recommends evaluating potential Lmax sound levels at sensitive noise receivers, particularly for those locations very near rail lines. The Lmax can identify short-term maximum sound levels associated with single events. Because several residences along the Custer Spur are very near the existing rail line and at-grade crossings, ENVIRON considered potential Lmax sound levels from locomotive horns for these locations.

ENVIRON calculated project-related L_{max} sound levels based on a locomotive horn sound level of 104 dBA at 100 feet. This source noise level was entered into the CadnaA noise model and maximum sound levels of the locomotive horn were estimated at the same receptor locations as considered above, except for W1, which is very distant from the rail line. Results of the horn noise modeling are displayed in Table 10.

Table 10. Model-Calculated L_{max} Sound Levels (dBA)

Receptor	Maximum Sound Level
SE1	61
SE2	58
SE3	64
SE4	67
E1	72
E2	72
E3	72
E4	80
E5	75
NE1	74
NE2	79
NE3	93
NE4	86
NE5	92
NE6	97
NE7	82
NE8	78
NE9	74
CUSTER1	78
CUSTER2	92
CUSTER3	90
CUSTER4	88
CUSTER5	86
CUSTER6	75
CUSTER7	69
CUSTER8	73
CUSTER9	77
CUSTER10	81
CUSTER11	82

Although FTA has not identified impact criteria based on the L_{max} noise metric, it is apparent that high exterior levels (e.g., L_{max} levels of 90 dBA or more) could potentially lead to interior sound levels loud enough to disturb sleep.

7 Mitigation

7.1 Construction

7.1.1 General Construction Activities and Equipment

Some relatively simple and inexpensive practices can reduce the extent to which people are affected by construction noise. Examples include using properly sized and maintained mufflers, engine intake silencers, engine enclosures, and turning off idle equipment. Construction contracts can specify that mufflers be in good working order and that engine enclosures be used on equipment when the engine is the dominant source of noise.

Substituting hydraulic or electric models for impact tools such as jack hammers, rock drills, and pavement breakers could reduce construction and demolition noise. Electric pumps could be specified if pumps are required.

Although as safety warning devices back-up alarms are exempt from noise ordinances, these devices emit some of the most annoying sounds from a construction site. One potential mitigation measure would be to ensure that all equipment required to use backup alarms utilize ambient-sensing alarms that broadcast a warning sound loud enough to be heard over background noise but without having to use a preset, maximum volume. Another alternative would be to use broadband backup alarms instead of typical pure tone alarms. Such devices have been found to be very effective in reducing annoying noise from construction sites.

For the most part, the temporary nature of construction coupled with the restriction of construction activities to daytime hours would minimize the potential for significant noise impacts.

7.1.2 Potential Pile Driving Airborne Noise Mitigation

The specific types of pile drivers have yet to be determined. Should impact piles be used for some or all of the project's required piles, there are a number of simple measures that can reduce the noise generated by impact-type pile driving. These measures provide only limited reduction, however, generally 5 dBA or less. Potential impact hammer noise reduction measures include the following, and some or all of these techniques could be employed to the extent practicable.

- Insert a wooden or plastic dolly between the pile head and the hammer.
- Apply a damping compound to steel piles to reduce the vibration/ringing.
- Silence the exhaust gas pulsations from the engines of diesel-powered hammers.
- Remove any unnecessary hanging chains; fix any loose bolts, panels, or over-slack leader guides.
- Use a cushioned method in conjunction with a "heavy hammer-short drop" practice. This requires using interference fit guides to prevent kicking, rolling and vibration in the pile. While the overall sound level is not substantially reduced, the nature of the sound may be less annoying to people.
- Provide regular equipment service and maintenance.
- Another potential mitigation for impact drivers would be to use a Hoesch Noise Abatement Tower. This device encloses the hammer and driven pile. It was designed to provide the maximum sound level reduction with minimum possible weight. The composite panel is

comprised of a "sandwiched" layer of 2 mm steel, .4 mm plastic, and 1.5 mm steel. A polyurethane layer 150 mm thick is foamed on the inner walls of the panels. This enclosure can reduce impact pile driving noise by up to 20 dBA. Drawbacks include the difficulty of using this device in water, which eliminates it as an option for most of the pile driving work. This mitigation also can be expensive.

7.2 Operational Noise Mitigation

7.2.1 On-Site Terminal Sources

As discussed in the section on construction noise mitigation above, noises from backup alarms are often identified as one of the most annoying sounds from sites/facilities where they are in use, particularly during nighttime operations. Potential mitigation of backup alarms could include the use of either broad-band and/or ambient-sensing vehicle back-up alarms. Broad-band alarms are typically less noticeable than traditional pure-tone alarms at more distant locations (i.e., away from the safe zone around a vehicle where the alarms are required and effective). This is especially true in active outdoor areas. Ambient sensing alarms sample the ambient sound level when a vehicle is about to back up, and emit a signal only 10-dBA louder than the existing level (as opposed to emitting a signal at a preset, maximum level). These types of alarms could be applied to the loader/dozer, stacker/reclaimer, trucks, and other mobile sources.

7.2.2 Off-Site Rail Sources

Wayside Horns

Because modeling identified potentially severe noise impacts near rail crossings of roads due to locomotive horn noise, ENVIRON evaluated how reducing noise from locomotive-mounted horns near two existing road crossings would affect these potential impacts. This review considered wayside horns installed at the crossings as an alternative to locomotive-mounted horns, which must start sounding about 15-20 seconds prior to the train reaching the crossing. Wayside horns operate in a manner that simulates locomotive-mounted horns, so both systems emit noise for about the same amount of time during each train passby. [7] But wayside horns are mounted on poles at the crossing and "aimed" at the oncoming traffic lanes, so they focus the warning signal noise directly towards the intended "audience," the traffic approaching the rail crossing. And because wayside horns are installed at fixed locations and produce highly directional sounds, they reduce the area farther from the crossing affected by horn noise. As a result, wayside horns can sometimes reduce impacts from train mounted horns by substantially lowering sound levels at sensitive receiving locations in the vicinity of railroad crossings.

To assess the potential effectiveness of using wayside horns instead of locomotive-mounted horns, ENVIRON used noise modeling to evaluate the noise from wayside horns at the railroad crossings of Bay and Kickerville Roads. These crossings were selected for this analysis because they are already controlled with automatic flashing lights and crossing gates, and

[7] The initiation of the sounding of both locomotive-mounted horns and wayside horns is based on the speed of the train as it approaches the crossing. Both types of horns start 15-20 seconds prior to the train reaching the crossing and continue until the lead locomotive passes through the crossing.

because locomotive horns sounded to allow safe passage of trains through these crossings are projected to result in severe noise impacts (as defined by FTA/FRA) at several nearby residential locations.

As shown in **Table 11**, noise modeling indicated the use of wayside horns instead of locomotive horns at these two road crossings could eliminate projected severe noise impacts at three nearby residences. This would leave only one remaining projected severe noise impact – at the residence nearest the railroad crossing at Ham Road (i.e., receptor Custer2). This crossing is not fitted with mechanical controls, so locomotive-mounted horns would continue to be used.

Note that the installation and use of wayside horns would require special efforts by both the railroad and the local roadway jurisdiction, and that the details of such arrangements remain to be considered in the future. For example, although the Federal Railroad Administration considers the use of wayside horns as being equivalent to the use of locomotive-mounted horns, wayside horns require additional infrastructure that is not needed with use locomotive horns. Examples of some of the potential issues follow.

- Wayside horns represent critical safety equipment with failsafe design so the drivers on approaching trains can confirm the systems are fully operational before not sounding the locomotive-mounted horns. These systems involve use of signs and circuitry on each side of a roadway crossing to allow the approaching locomotive driver time to confirm that the wayside horns are functioning properly and to give the safety system time to sense the train speed and activate the horns 15-20 seconds prior to the train reaching the crossing. These systems require cabling and power, and the circuitry requires continuously welded tracks, so the infrastructure is more involved than in the absence of wayside horns.
- For purposes of increasing safety with wayside horns, BNSF also recommends installing 60' to 100' of non-mountable median on both roadway approaches to each railroad crossing to prevent automobiles from being driven around warning gates. Such safety medians can require widening the road near the crossing.
- Wayside horns are not owned or maintained by BNSF and therefore become the responsibility of the local roadway jurisdiction.

These and possibly other issues related to using wayside horns as noise mitigation will need to be discussed and resolved in the future.

General Train/Rail Mitigation

Several standard railroad practices will also serve to mitigate the sound from trains. These include the following routine maintenance measures:

- Maintenance of the train wheels to minimize wheel flats
- Regular grinding of the rails to ensure they remain in good condition
- Reduction of on- and off-site idling time. Use of AESS can also be used to reduce long-term idling noise near the project facility
- Regular maintenance of locomotives

Table 11. Impacts from Project-Related Noise Increases over Existing Levels – Using Wayside Horns at Bay and Kickerville Road Crossings (dBA, L_{dn})

Receptor	Existing Level	Project Level	Cumulative Level	Increase	Moderate Impact? [a]		Severe Impact? [a]	
W1	56	40	56	0	56-62	N	>62	N
SE1	60	54	61	1	58-63	N	>63	N
SE2	58	53	59	1	57-62	N	>62	N
SE3	53	55	57	4	55-60	N	>60	N
SE4	61	55	62	1	59-64	N	>64	N
E1	57	56	60	2	57-62	N	>62	N
E2	57	56	59	3	57-62	N	>62	N
E3	56	56	59	3	56-62	N	>62	N
E4	62	58	63	1	59-64	N	>64	N
E5	56	53	58	2	56-62	N	>62	N
NE1	62	54	62	1	59-64	N	>64	N
NE2	58	57	61	2	57-62	Y	>62	N
NE3	65	62	67	2	61-66	Y	>66	N
NE4	61	58	63	2	59-64	N	>64	N
NE5	64	65	68	4	61-65	Y	>65	N
NE6	67	65	69	2	63-67	Y	>67	N
NE7	59	55	60	1	58-63	N	>63	N
NE8	55	53	57	2	56-61	N	>61	N
NE9	53	53	56	3	55-60	N	>60	N
CUSTER1	55	54	58	2	56-61	N	>61	N
CUSTER2	63	66	68	5	60-65	Y	>65	Y
CUSTER3	63	64	67	4	60-65	Y	>65	N
CUSTER4	61	63	65	4	59-64	Y	>64	N
CUSTER5	61	59	63	2	59-64	Y	>64	N
CUSTER6	52	58	59	7	55-60	Y	>60	N
CUSTER7	51	57	58	6	54-60	Y	>60	N
CUSTER8	51	56	57	6	54-60	Y	>60	N
CUSTER9	55	56	59	3	56-61	Y	>61	N
CUSTER10	56	56	59	3	56-62	Y	>62	N
CUSTER11	57	57	60	3	57-62	N	>62	N

[a] Tests of moderate and severe noise impacts are based on comparison with FTA noise impact criteria.

8 References

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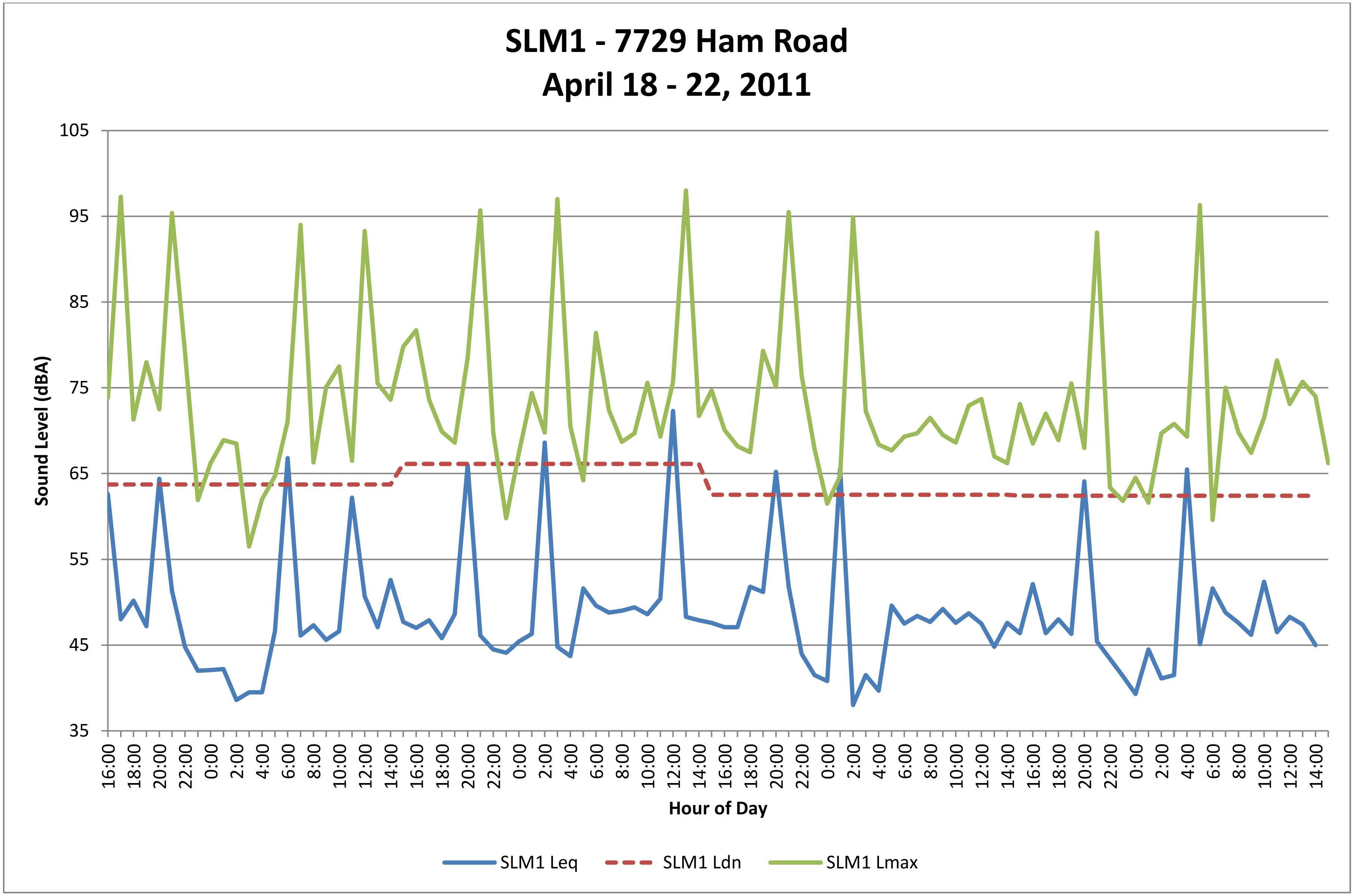
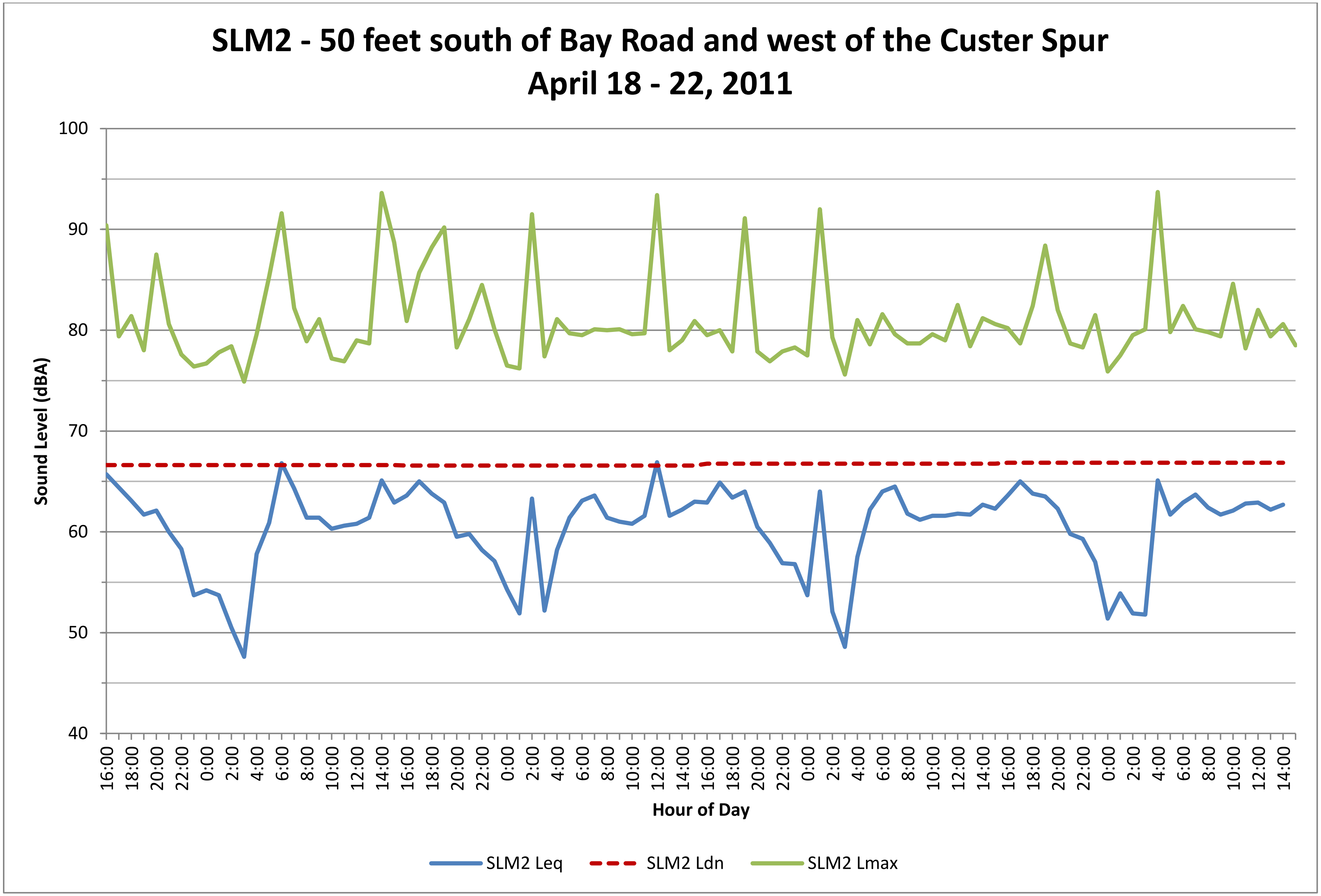
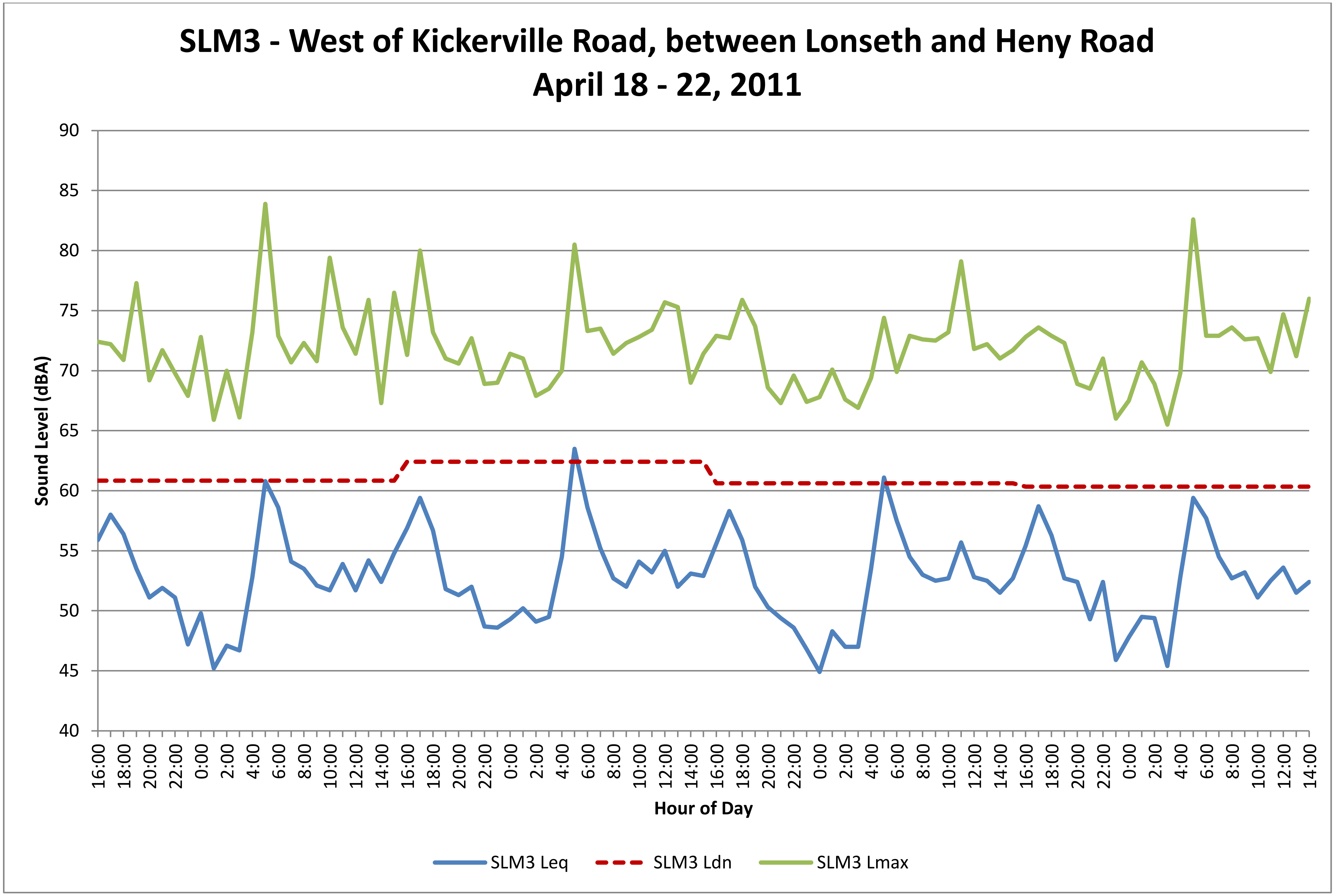
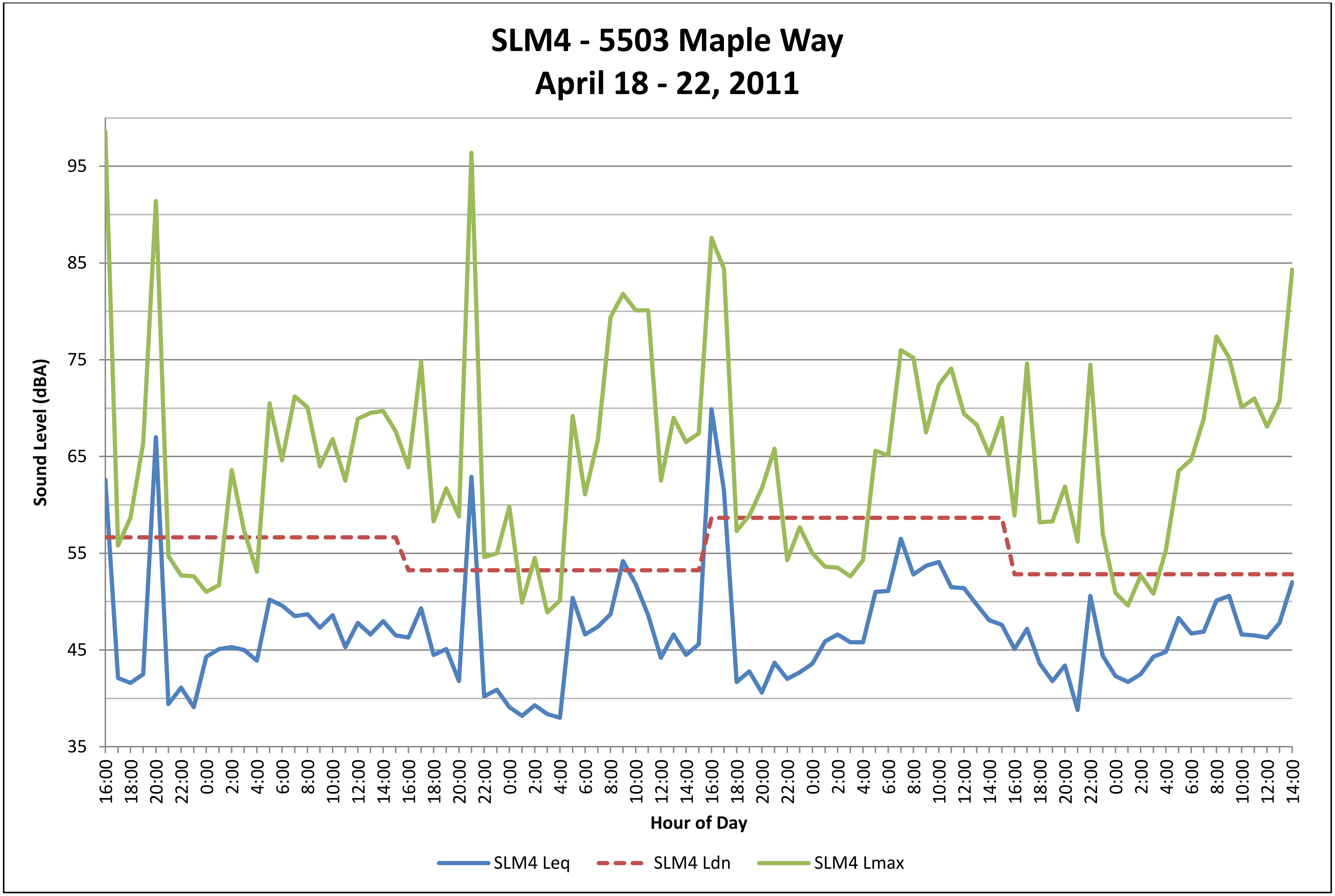
Appendix A : Sound Level Measurement Data


SLM1 - 7729 Ham Road
April 18 - 22, 2011
Sound Level (dBA)
105
95
85
75
65
55
45
35
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
Hour of Day
SLM1 Leq
SLM1 Ldn
SLM1 Lmax


SLM2 - 50 feet south of Bay Road and west of the Custer Spur
April 18 - 22, 2011
Sound Level (dBA)
100
90
80
70
60
50
40
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
Hour of Day
SLM2 Leq
SLM2 Ldn
SLM2 Lmax


SLM3 - West of Kickerville Road, between Lonseth and Heny Road
April 18 - 22, 2011
Sound Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
Hour of Day
SLM3 Leq
SLM3 Ldn
SLM3 Lmax


SLM4 - 5503 Maple Way
April 18 - 22, 2011
Sound Level (dBA)
95
85
75
65
55
45
35
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
Hour of Day
SLM4 Leq
SLM4 Ldn
SLM4 Lmax